

Application No. 09/534,723
 Group Art Unit: 1772

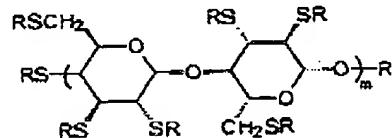
Docket No.: 8733.229.00
 Page 2 of 15

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Currently Amended) A liquid crystal display device, comprising:
 first and second substrates;
 a first alignment layer on the first substrate, wherein the first alignment layer includes



where the spacer S is selected from the group consisting of oxygen, sulfur, NH, OC_hH_{2h} , and $\text{OC}_h\text{H}_{2h}\text{O}$, where $h = 1\sim 5$ and $m = 10\sim 10,000$, and
 the functional group R includes a material selected from consisting of OH, SH, and



wherein X_1 and X_2 are each selected from the group consisting of hydrogen, fluorine, chlorine, CN, NO_2 , CH_3 , OCH_3 , CF_3 , and OCF_3 ; k is 0 to 1; Y is selected from the group consisting of hydrogen, fluorine, chlorine, CN, NO_2 , CF_3 , OCF_3 , $\text{C}_n\text{H}_{2n+1}$, $\text{OC}_n\text{H}_{2n+1}$, $\text{C}_n\text{H}_{2n+1-x}\text{F}_x$, and $\text{OC}_n\text{H}_{2n+1-x}\text{F}_x$ ($n = 1\sim 10$, $x = 1\sim 2n+1$); and

a liquid crystal layer between the first and second substrate.

Application No.: 09/534,723
Group Art Unit: 1772

Docket No.: 8733.229.00
Page 3 of 15

2. (Original) The liquid crystal display device according to claim 1, further comprising a second alignment layer on the second substrate.

3. (Original) The liquid crystal display device according to claim 2, wherein the second alignment layer includes a material selected from the group consisting of a pyranose polymer, a furanose polymer, polyvinyl cinnamate, polysiloxane cinnamate, polyvinyl alcohol, polyamide, polyimide, polyamic acid and silicone dioxide.

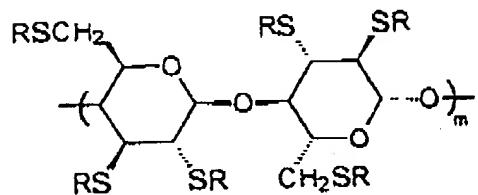
4. (Original) The liquid crystal display device according to claim 2, wherein at least one of the first and second alignment layers is divided into at least two domains for driving liquid crystal molecules in the liquid crystal layer differently on each domain.

Claims 5 and 6 (Canceled).

7. (Withdrawn) A liquid crystal display device, comprising:

first and second substrates;

a first alignment layer on the first substrate, wherein the first alignment layer includes



(spacer S is sulfur, m = 10~10,000),

the functional group R includes at least one of a group consisting of photo-sensitive constituents and non-photo-sensitive constituents; and

Application No.: 09/534,723
Group Art Unit: 1772

Docket No.: 8733.229.00
Page 4 of 15

a liquid crystal layer between the first and second substrates.

8. (Withdrawn) The liquid crystal display device according to claim 7, further comprising a second alignment layer on the second substrate.

C |
9. (Withdrawn) The liquid crystal display device according to claim 8, wherein the second alignment layer includes a material selected from the group consisting of a pyranose polymer, a furanose polymer, polyvinyl cinnamate, polysiloxane cinnamate, polyvinyl alcohol, polyamide, polyimide, polyamic acid and silicone dioxide.

10. (Withdrawn) The liquid crystal display device according to claim 8, wherein at least one of the first and second alignment layers is divided into at least two domains for driving liquid crystal molecules in the liquid crystal layer differently on each domain.

11. (Withdrawn) The liquid crystal display device according to claim 7, wherein the photo-sensitive constituent includes a material selected from the group consisting of cinnamoyl derivatives.

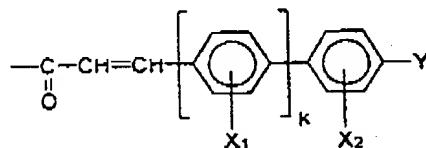
12. (Withdrawn) The liquid crystal display device according to claim 7, wherein the non-photo-sensitive constituents include a material selected from the group consisting of H, C_nH_{2n} , C_nH_{2n+1} , $C_nH_{2n}OH$, COC_nH_{2n+1} , $C_nH_{2n+1-x}F_x$, $C_nH_{2n-(x-1)}F_{(x-1)}$, $C_nH_{2n-(x-1)}F_{(x-1)}OH$, $COC_nH_{2n+1-x}F_x$ ($n = 1 \sim 10$, $x = 1 \sim 2n+1$), and a combination thereof.

Application No.: 09/534,723
 Group Art Unit: 1772

Docket No.: 8733.229.00
 Page 5 of 15

13. (Withdrawn) The liquid crystal display device according to claim 11, wherein the cinnamoyl derivative includes at least one member selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO₂, CH₃, OCH₃, CF₃, OCF₃, C_nH_{2n+1}, OC_nH_{2n+1}, C₆H₅, C₆H₄OC_nH_{2n+1}, C_nH_{2n+1-x}F_x, OC_nH_{2n+1-x}F_x (n = 1~10, x = 1~2n+1).

14. (Withdrawn) The liquid crystal display device according to claim 11, wherein the cinnamoyl derivative is

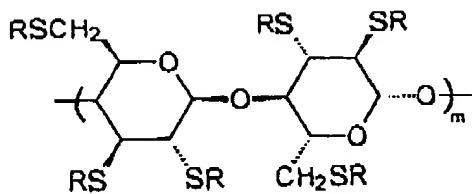


(X₁ and X₂ are each selected from the group consisting of hydrogen, fluorine, chlorine, CN, NO₂, CH₃, OCH₃, CF₃, OCF₃; k is 0 to 1; Y is selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO₂, CF₃, OCF₃, C_nH_{2n+1}, OC_nH_{2n+1}, C_nH_{2n+1-x}F_x, OC_nH_{2n+1-x}F_x (n = 1~10, x = 1~2n+1)).

15. (Withdrawn) A liquid crystal display device, comprising:

first and second substrates;

a first alignment layer on the first substrate, wherein the first alignment layer includes



(spacer S is NH, m = 10~10,000),

Application No.: 09/534,723
Group Art Unit: 1772

Docket No.: 8733.229.00
Page 6 of 15

the functional group R includes at least one of a group consisting of photo-sensitive constituents and non-photo-sensitive constituents; and a liquid crystal layer between the first and second substrates.

16. (Withdrawn) The liquid crystal display device according to claim 15, further comprising a second alignment layer on the second substrate.

17. (Withdrawn) The liquid crystal display device according to claim 16, wherein the second alignment layer includes a material selected from the group consisting of a pyranose polymer, a furanose polymer, polyvinyl cinnamate, polysiloxane cinnamate, polyvinyl alcohol, polyamide, polyimide, polyamic acid and silicone dioxide.

18. (Withdrawn) The liquid crystal display device according to claim 16, wherein at least one of the first and second alignment layers is divided into at least two domains for driving liquid crystal molecules in the liquid crystal layer differently on each domain.

19. (Withdrawn) The liquid crystal display device according to claim 15, wherein the photo-sensitive constituents include a material selected from the group consisting of cinnamoyl derivatives.

20. (Withdrawn) The liquid crystal display device according to claim 15, wherein the non-photo-sensitive constituents include a material selected from the group consisting of H,

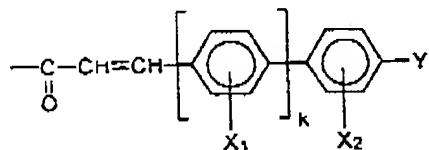
Application No.: 09/534,723
 Group Art Unit: 1772

Docket No.: 8733.229.00
 Page 7 of 15

C_nH_{2n} , C_nH_{2n+1} , $C_nH_{2n}OH$, COC_nH_{2n+1} , $C_nH_{2n+1-x}F_x$, $C_nH_{2n-(x-1)}F_{(x-1)}$, $C_nH_{2n-(x-1)}F_{x-1}OH$, $COC_nH_{2n+1-x}F_x$ ($n = 1-10$, $x = 1-2n+1$), and a combination thereof.

21. (Withdrawn) The liquid crystal display device according to claim 19, wherein the cinnamoyl derivative includes at least one member selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO_2 , CH_3 , OCH_3 , CF_3 , OCF_3 , C_nH_{2n+1} , OC_nH_{2n+1} , C_6H_5 , $C_6H_4OC_nH_{2n+1}$, $C_nH_{2n+1-x}F_x$, $OC_nH_{2n+1-x}F_x$ ($n = 1-10$, $x = 1-2n+1$).

22. (Withdrawn) The liquid crystal display device according to claim 19, wherein the cinnamoyl derivative is



(X_1 and X_2 are each selected from the group consisting of hydrogen, fluorine, chlorine, CN, NO_2 , CH_3 , OCH_3 , CF_3 , OCF_3 ; k is 0 to 1; Y is selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO_2 , CF_3 , OCF_3 , C_nH_{2n+1} , OC_nH_{2n+1} , $C_nH_{2n+1-x}F_x$, $OC_nH_{2n+1-x}F_x$ ($n = 1-10$, $x = 1-2n+1$)).

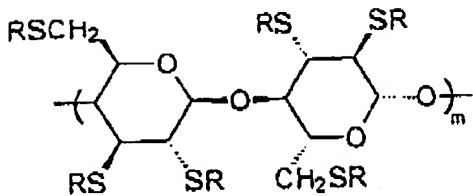
23. (Withdrawn) A liquid crystal display device, comprising:

first and second substrates;

a first alignment layer on the first substrate, wherein the first alignment layer includes

Application No.: 09/534,723
Group Art Unit: 1772

Docket No.: 8733.229.00
Page 8 of 15



(spacer S is OC_hH_{2h} ($h = 1-5$), $m = 10-10,000$),

the functional group R includes at least one of a group consisting of photo-sensitive constituents and non-photo-sensitive constituents; and
a liquid crystal layer between the first and second substrates.

24. (Withdrawn) The liquid crystal display device according to claim 23,

further comprising a second alignment layer on the second substrate.

25. (Withdrawn) The liquid crystal display device according to claim 24, wherein the second alignment layer includes a material selected from the group consisting of a pyranose polymer, a furanose polymer, polyvinyl cinnamate, polysiloxane cinnamate, polyvinyl alcohol, polyamide, polyimide, polyamic acid and silicone dioxide.

26. (Withdrawn) The liquid crystal display device according to claim 24, wherein at least one of the first and second alignment layers is divided into at least two domains for driving liquid crystal molecules in the liquid crystal layer differently on each domain.

27. (Withdrawn) The liquid crystal display device according to claim 23, wherein the photo-sensitive constituents include a material selected from the group consisting of cinnamoyl derivatives.

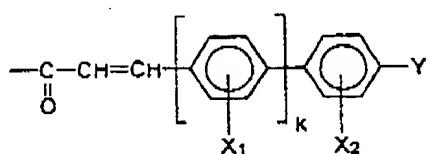
Application No.: 09/534,723
Group Art Unit: 1772

Docket No.: 8733.229.00
Page 9 of 15

28. (Withdrawn) The liquid crystal display device according to claim 23, wherein the non-photo-sensitive constituents include a material selected from the group consisting of H, OC_nH_{2n}, OC_nH_{2n+1}, COC_nH_{2n+1}, C_nH_{2n}OH, OC_nH_{2n}OH, OCOC_nH_{2n+1}, OC_nH_{2n+1-x}F_x, OC_nH_{2n-(x-1)}F_(x-1), C_nH_{2n-(x-1)}F_(x-1)OH, OC_nH_{2n-(x-1)}F_{x-1}OH, COC_nH_{2n+1-x}F_x, OCOC_nH_{2n+1-x}F_x (n = 1~10, x = 1~2n+1), and a combination thereof.

29. (Withdrawn) The liquid crystal display device according to claim 27, wherein the cinnamoyl derivative includes at least one member selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO₂, CH₃, OCH₃, CF₃, OCF₃, C_nH_{2n+1}, OC_nH_{2n+1}, C₆H₅, C₆H₄OC_nH_{2n+1}, C_nH_{2n+1-x}F_x, OC_nH_{2n+1-x}F_x (n = 1~10, x = 1~2n+1).

30. (Withdrawn) The liquid crystal display device according to claim 27, wherein the cinnamoyl derivative is



(X₁ and X₂ are each selected from the group consisting of hydrogen, fluorine, chlorine, CN, NO₂, CH₃, OCH₃, CF₃, OCF₃; k is 0 to 1; Y is selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO₂, CF₃, OCF₃, C_nH_{2n+1}, OC_nH_{2n+1}, C_nH_{2n+1-x}F_x, OC_nH_{2n+1-x}F_x (n = 1~10, x = 1~2n+1)).

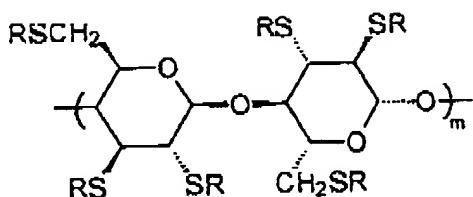
31. (Withdrawn) A liquid crystal display device, comprising:

Application No.: 09/534,723
Group Art Unit: 1772

Docket No.: 8733.229.00
Page 10 of 15

first and second substrates;

a first alignment layer on the first substrate, wherein the first alignment layer includes



(spacer S is OC_hH_{2h}O (h = 1~5), m = 10~10,000),

the functional group R includes at least one of a group consisting of photo-sensitive constituents and non-photo-sensitive constituents; and

a liquid crystal layer between the first and second substrates.

32. (Withdrawn) The liquid crystal display device according to claim 31,

further comprising a second alignment layer on the second substrate.

33. (Withdrawn) The liquid crystal display device according to claim 32, wherein the second alignment layer includes a material selected from the group consisting of a pyranose polymer, a furanose polymer, polyvinyl cinnamate, polysiloxane cinnamate, polyvinyl alcohol, polyamide, polyimide, polyamic acid and silicone dioxide.

34. (Withdrawn) The liquid crystal display device according to claim 32, wherein at least one of the first and second alignment layers is divided into at least two domains for driving liquid crystal molecules in the liquid crystal layer differently on each domain.

Application No.: 09/534,723
Group Art Unit: 1772

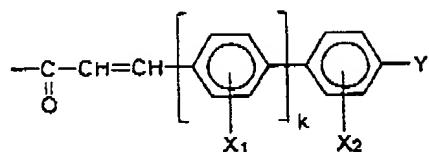
Docket No.: 8733.229.00
Page 11 of 15

35. (Withdrawn) The liquid crystal display device according to claim 31, wherein the photo-sensitive constituents include a material selected from the group consisting of cinnamoyl derivatives.

36. (Withdrawn) The liquid crystal display device according to claim 31, wherein the non-photo-sensitive constituents include a material selected from the group consisting of H, C_nH_{2n} , C_nH_{2n+1} , $C_nH_{2n}OH$, COC_nH_{2n+1} , $C_nH_{2n+1-x}F_x$, $C_nH_{2n-(x-1)}F_{(x-1)}$, $C_nH_{2n-(x-1)}F_{x-1}OH$, $COC_nH_{2n+1-x}F_x$ ($n = 1 \sim 10$, $x = 1 \sim 2n+1$), and a combination thereof.

37. (Withdrawn) The liquid crystal display device according to claim 35, wherein the cinnamoyl derivative includes at least one member selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO_2 , CH_3 , OCH_3 , CF_3 , OCF_3 , C_nH_{2n+1} , OC_nH_{2n+1} , C_6H_5 , $C_6H_4OC_nH_{2n+1}$, $C_nH_{2n+1-x}F_x$, $OC_nH_{2n+1-x}F_x$ ($n = 1 \sim 10$, $x = 1 \sim 2n+1$).

38. (Withdrawn) The liquid crystal display device according to claim 35, wherein the cinnamoyl derivative is



(X_1 and X_2 are each selected from the group consisting of hydrogen, fluorine, chlorine, CN, NO_2 , CH_3 , OCH_3 , CF_3 , OCF_3 ; k is 0 to 1; Y is selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO_2 , CF_3 , OCF_3 , C_nH_{2n+1} , OC_nH_{2n+1} , $C_nH_{2n+1-x}F_x$, $OC_nH_{2n+1-x}F_x$ ($n = 1 \sim 10$, $x = 1 \sim 2n+1$)).

Application No.: 09/534,723
Group Art Unit: 1772

Docket No.: 8733.229.00
Page 12 of 15

39. (Withdrawn) A liquid crystal display device, comprising:
first and second substrates;
an alignment layer on the first substrate, wherein the alignment layer includes a cellulose, a derivative of a cinnamoyl group and a spacer between a main polymer chain and the derivative of the cinnamoyl group; and
a liquid crystal layer between the first and second substrates.

40. (Withdrawn) The liquid crystal display device according to claim 39, wherein the derivative of the cinnamoyl group includes at least one member selected from the group consisting of hydrogen, fluorine, chlorine, cyano, NO₂, CH₃, OCH₃, CF₃, OCF₃, C_nH_{2n+1}, OC_nH_{2n+1}, C₆H₅, C₆H₄OC_nH_{2n+1}, C_nH_{2n+1-x}F_x, OC_nH_{2n+1-x}F_x (n = 1~10, x = 1~2n+1).

41. (Withdrawn) The liquid crystal display device according to claim 39, wherein the spacer includes at least one member selected from the group consisting of oxygen, sulfur, NH, OC_nH_{2n}, OC_nH_{2n}O (n = 1~5).

42. (Withdrawn) The liquid crystal display device according to claim 39, wherein the alignment layer is divided into at least two domains to drive differently liquid crystal molecules in the liquid crystal layer on each domain.